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THE INACCURACY OF DESCRIPTION OF PHOTOGRAPHIC OBJECTIVES BY MANUFACTURERS AND EDITORS.

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BARRING the last two words, the above is the title of a paper by Mr. W. A. Cheyney that particularly attracted my notice in your issue for April. The paper is to the point, and is on a subject that ought to be thoroughly ventilated.

Put briefly the matter is this: a number of opticians make lenses especially for photographic use. Many of these lenses are, considering the conflicting requirements of a photographic lens, so good that they are a standing wonder. The opticians charge a pretty stiff price for them, but of that we—the buying public—do not complain. We ask, however, if it is not unreasonable to demand that the descriptions of these lenses, in catalogues and advertisements, be at least fairly accurate, that they be not disfigured by a lack of intelligence that would bring ridicule on the advertisement of a tailor or shoemaker.

It is probable that the catalogues and advertisements of most manufacturers of photographic lenses are a relic of the time when the greater number of photographers were ignorant of the most rudimentary facts not only of optics, but even of the properties of the lenses they used: when anything about the ratio of aperture to focal length was a mystery profound, when it was commonly supposed that there was some fetish in a "portrait lens," apart from the angular aperture, making it particularly suitable for

portraiture: when, particularly, there were wonderful delusions about depth of focus, when, in fact, it would have been useless to afford the information now so generally demanded.

There are exceptions to every rule, and there are some (English, at any rate) opticians who issue catalogues giving all the information wanted. I think of one in particular who sends out a large sheet giving the equivalent focus and the maximum working apertures of all the different sizes of the different classes of lenses that he makes. I know, too, that with this optician the actual equivalent focus is always very nearly that stated in the sheet, that the apertures are actually those stated; and I believe that if a lens of precisely the focus mentioned is wanted, the fact has only to be stated.

How different it is with many opticians was forcibly brought to my attention a little time ago. My advice was asked about buying lenses for a particular kind of work. I soon decided on the class of lens wanted, but it was necessary to determine from whom the lenses should be ordered, and hence a great rummaging through catalogues. It was quite essential to know the equivalent focus and also the maximum working aperture before ordering the lenses. Now, in the catalogues of three English opticians of high repute, there were found the following anomalies. One gave, throughout, the equivalent focus of the lenses, but nowhere stated the working aperture. Another gave the equivalent focus of the lenses and their diameters, accompanied by diagrams showing that the working aperture was in most cases much less than the diameters of the actual combinations. In the catalogue of still a third optician, there were given, for some lenses, both the equivalent and the back focus (almost a work of supererogation), for others the equivalent focus only (just what was wanted), for still others merely the focus. In this last case, it was only actual experience of the lenses that enabled me to know that it was the back focus that was stated. It is some slight consolation to think that these opticians lost all chance of at least one order, simply from the idiotic way in which their catalogues were put together.

There are other offences committed by manufacturers of lenses. Why, for example, should the intelligence of the photographic

public be insulted by advertisements of wide-angle lenses headed "these lenses include an angle of more than 100°," whilst below there is a table of the sizes of plates that the lenses will cover with "large, medium, and small stop," which table shows that the lenses will not include an angle approaching 100° even with the small stop, and taking the diagonal of the plate into consideration?

As for lenses not having the apertures advertised, I think that perhaps English opticians are a little more conscientious in this matter than Americans, although I can be by no means sure. Very often where "aperture" is mentioned, or is inferred by stating that the angular aperture is so and so, and giving the equivalent focus of the lens, it is found that the diameter is actually that of the glasses of the lens, and that the cell cuts it down very appreciably, or that a fixed stop contracts the working aperture. In judging of the latter matter, however, it should always be borne in mind that in the case of double combination lenses, the fixed aperture may be a little less in diameter than the front combination without cutting off any light, because this light is somewhat concentrated by the front lens before it reaches the stop.

There has been a great improvement amongst English opticians within the last few years, in the matter of the accuracy of cutting stops. It is not so long ago that they were cut at pure random. Even for some time after certain opticians professed to have adopted the Universal Standard, the stops were seldom even approximately in accordance with it.

Now for the editors and others who write in the periodical press about lenses. To the like of myself, living thousands of miles from the nearest place where photographic lenses are made, it is of the first importance that the descriptions of new lenses given in the photographic periodicals should be intelligible. Sometimes they are; but alas how often they are not! By the same mail that brought the issue of the AMERICAN JOURNAL OF PHOTOGRAPHY above mentioned, there was brought a copy of an American contemporary: a journal that I value much,—because it is edited by two people of talent, and the reading matter is generally excellent.

Under the head of "Editorial Comment," I came on a paragraph beginning, "An improved lens." This at once attracted my attention, the more particularly as after a few preliminary remarks on the "wonderful discoveries made in optics and chemistry," it was stated that the lens is made of the new Jena glass. Now I particularly want to know something definite about the results of the use of the new Jena glass for photographic lenses. The next statement, however, is, to say the least of it, confusing. It read that, "it is made . . . single, rapid, rectilinear, and wide-angle, and does, as the makers claim, work with full aperture, sharp to the edges of the plate." This remarkable statement wants a deal of consideration. Is there actually one lens that combines all the qualities here mentioned? That is, at the same time, "single, rapid, rectilinear, and wide-angle"? Although there is nothing in the "Comment" to clearly indicate it, I am forced to suppose that there are three different kinds of lenses, because for one thing I imagine it is impossible, even with the Jena glass, to make a lens having all the qualities indicated above. What on earth use it is to know that "it . . . does . . . work, with full aperture, sharp to the edges of the plate," without any statement of focal length, maximum aperture, or size of plate, is a thing that I leave to your readers.

A little lower we learn that "those of long focus are something like the new lens of Dallmeyer, which is making such a sensation abroad." One is inclined to interpolate "something like a whale."

But at this stage comes the most interesting part of the whole description. We learn that "The great value of the lens lies . . . in an attachment which can be put in place of the rear combination, and produces actinically modified rays of light, thus reducing harsh contrasts and obviating in portrait work the necessity of retouching. The results as described are remarkable, and give much the same effect as orthochromatic plates." Remarkable! I should think so with a vengeance! A lens obviating the necessity of retouching, and giving the same effect as orthochromatic plates!

Leaving on one side the extraordinary property of a "rear combination" that can "produce" rays of light . . . whether in

the vulgar sense of originating, or in the geometrical of extending in the same straight line . . . what in the world can this attachment be? At first it seemed to me that it might be a diffusion of focus arrangement, although it is difficult to see how that could give "the same effect as orthochromatic plates," and I hailed the information with pleasure, for a landscape lens with a diffusion of focus arrangement is still a desideratum. What comes farther on seems, however, to contradict this idea.

It presently transpires that "we have only tried the ordinary rapid rectilinear, but have ordered the violet light attachment." Angels and ministers of grace, defend us! What does this mean? I thought that all the lenses, if there were really three of them, were not ordinary, but extraordinary, particularly considering that "those of long focus are something like the new lens of Dallmeyer." Then if only "the ordinary rapid rectilinear" was tried, how about the implied evidence that it, this three-in-one lens, in in all its forms was found to work with full aperture to the edges of the plate "as its makers claim"? But the "violet light attachment" beats all!

For the nearest approach to definite information that we have in the "Comment" is that "Miss Barnes will probably use the lens in her European tour the coming summer!"

Surely we may demand with reason that the manufacturers of lenses shall describe their goods a little more intelligently than they do, and that commenting editors, unless they can tell us something more definite about lenses that they have tested than do these referred to, should hold their peace.

Over the editors we have no control. Over the opticians we have to a certain extent, and I suggest that all photographers should do what they can, by promptly returning lenses that are not in accordance with catalogue description, demanding either a return of their money or a lens that is in accordance with the description. Farther, that where other things are equal, they give their custom to those opticians who issue intelligible catalogues, and whose goods are found to be in accordance with their advertisements.

COMPOSITE HELIOCHROMY.

THE reception accorded in England to our townsman, Fred. E. Ives, of Philadelphia, is most gratifying. His demonstrations in the reproduction of the colors of nature by photographic means before the English Royal Institute on May 3d and 4th, called forth nothing but praise from both press and public. The lecture and demonstration were repeated by request on May 25th before the Society of Arts in London, upon which occasion the chairman, J. W. Swan, F.C.S., in introducing Mr. Ives, said:

"Mr. Ives needs no introduction to an English audience; his work in connection with the translation of the continuous gradation of an ordinary photograph into discontinuous gradation is known throughout the world. The excellent quality of the half-tone photographic engravings—so profusely employed in the illustrated literature in America—is largely due to Mr. Ives' initiative. But to-night we are to hear and see the results of his labors in a different direction,—that of photography in natural colors, an object of desire that arose in the minds of almost the earliest workers of photography. No sooner had that miracle of science—the production of a photograph in light and shade—been wrought, than the insatiable striving after something higher and better—the best attribute of the human mind—asserted itself in the desire for color in addition to light and shade; and very soon this desire received the stimulus of what appeared to be, if not a complete, at any rate, an approximate solution of this problem. In the exhibition of 1851, I remember seeing a photograph on a Daguerreotype plate, which showed some quite vivid colors in the dress of a doll. It was a photograph by Becquerel, and it seemed as though very little more had to be done to realize a perfect result; but that seeming has proved to be illusive; the colors were, to a large extent, accidental, and they were not permanent, and as a matter of fact very little more has been accomplished since that time in that particular line of working. The colors were due, not to any selective action of the light corresponding to them, but to quantitative effect. The principle was false.

The only substantial advance that has been made since that time has been made on the different principles of working, followed by Dr. Vogel and Mr. Ives; unless the recent announcement in connection with the achievements of Mons. Lippmann should prove to be true. For fourteen years past Mr. Ives has labored to produce color photographs by the composite method, believing that this was the only road by which success was to be reached."

After this introduction, Mr. Ives read his paper on "Composite Heliochromy," explaining the process with illustrations in natural colors upon the screen. After the exhibition, the following interesting discussion took place, viz.:

The chairman said photography in natural colors, as generally understood, was something different from what Mr. Ives had now shown. What had been wished, but hardly hoped for, was a photograph in which all the colors of nature would be reproduced on one plane surface, in one picture, directly in the camera, and by one print. Mr. Ives had not given them the whole loaf, but he had produced something which might perhaps be esteemed a good half of it. He had shown some very beautiful results, and had explained the means and the principle on which they have been produced with singular clearness and precision. He had shown that in the production of the photographs to form the basis of color photograph combination, not only had the character of the sensitive surface to be considered in photographing the radiations from particular colors, but also the screen to be combined with a particular quality of color-sensitiveness in the plate, and that the separate consideration of either screen or sensitive plate was useless. Mr. Ives's teaching and procedure in relation to the production of negatives for the production of color photographs were applicable not only to the kind of pictures he had shown that evening, but also threw a strong light on the principles to be followed in copying paintings and colored objects generally, with a view to rendering in correct monochrome all the different values of the color in the oil painting. He conceived that to be a very useful application of the principles now explained.

Professor Roberts-Austen, F.R.S., wished to express his appreciation of the extreme ingenuity displayed in the construction of

the camera, and in arranging these marvellous optical effects which had been shown. He had had the privilege of visiting Yellowstone Park, and could bear testimony to the extraordinary fidelity with which the marvellous color effects there seen had been reproduced.

Mr. B. Francis Cobb said there was very little room for discussion; they had simply to listen and learn, and admire the extraordinary results Mr. Ives had obtained. It had frequently been said that if ever color photography was to be achieved, it would be by some means at present little expected, or by some totally new appliance. Mr. Ives was certainly opening the way to what in future might lead to very great results, and he (Mr. Cobb) could only hope that Mr. Ives would continue the researches which all were watching with the greatest interest, and that later on he would come before them again with still further advances.

Mr. Van der Weyde asked if anything had been done in the way of portraiture by this method. He apprehended the exposure would have to be prolonged, and the light very strong, so that perhaps the sitter would have to close his eyes during the operation.

Mr. William H. Ward said he had had the opportunity last winter of seeing in Mr. Ives's own house in Philadelphia, several of the pictures now shown, and he could say that when displayed by sunlight they were quite fifty per cent. better. That would give some idea of the improved effect which would be obtained with a lantern fitted with an arc light.

Sir Henry Trueman Wood said it would be interesting if Mr. Ives could give some further information as to the way in which he regulated the exposure for each of the three pictures produced on the same film. As he understood, they were all produced simultaneously on one film and developed at the same time, and consequently the amount of exposure for each must be carefully regulated. It was obvious that the picture produced by the red rays must require a very much longer exposure than the one produced by rays of higher refrangibility; it would be interesting to know how it was done. One could understand that it might be regulated by varying the size of the aperture, or by other means.

A great deal of credit was due to Mr. Ives for the extreme ingenuity with which he had rendered practically useful a method which had been in the minds of a great many people for a long time, and which had been accomplished, with a varying amount of success, by previous experimenters. But Mr. Ives has certainly achieved in this particular direction a very distinct success. The practical application of it had yet to be seen, though it was not difficult to see that it had many possibilities of usefulness.

The chairman said he should like to know what kind of plate was most suitable for taking these negatives, and whether Mr. Ives had a preference for one particular kind of plate rather than another.

Mr. Ives, in reply, said he thought a special plate should be manufactured for this work, slightly modified from anything now on the market, but in order to make the operation sufficiently easy and convenient he had adopted commercial orthochromatic plates; the results shown were all obtained with commercial plates manufactured by Messrs. Carbutt, of Philadelphia. The one picture which would be seen in the heliochromoscope, a bouquet of English flowers, was taken on an Edwards isochromatic plate, which was very similar. There were two methods of securing simultaneous equal exposure for three pictures, the plates not being anything like so sensitive to red as to the other colors. If the three pictures were taken at one exposure through a single lens, the ray being divided after it passed through the lens, he had a number of ground and smoked glasses of different degrees of density, and having adjusted the color screen to give the density grades he wanted in the spectrum negative, he inserted one or more smoked glasses until he found three pictures developed together after the same exposure. He had another camera in which the pictures were taken on one film by three separate lenses, and in that case the diaphragms were varied; that for the red being much larger than that for the other two. It would be possible to take a portrait by this process now, but it would require an exposure of three or four minutes in a strong light. Plates could be specially prepared which would reduce the exposure in a strong light to possibly fifteen or twenty seconds, but inasmuch as the

process was not practically available for portrait-work at present, he had not troubled himself with experiments in that direction.

The chairman then proposed a vote of thanks to Mr. Ives, which was carried unanimously.

ELEMENTARY THEORY OF THE EQUIVALENT FOCUS.

BY PROF. HENRY CREW, LICK OBSERVATORY.

RECENT progress in the manufacture and use of photographic lenses indicates that the time is near at hand, if not already here, when the skilful photographer must have some accurate knowledge of the optical properties of the lenses he employs.

Take, for instance, the new enlarging lenses which have recently come into prominence. The user asks himself at once how a camera measuring eighteen or twenty inches from the front surface of the lens to the ground glass can make a picture on the same scale as an ordinary doublet having a focal length of sixty or a hundred inches.

To be sure, good photographs are daily taken by those who possess no knowledge of the chemistry of developers or fixing solutions; but such knowledge is a very great aid to him who wishes to push a little over the border, and into the unknown. Clear optical ideas may be classed in the same category.

The history of photography in this direction, viz., towards greater precision of detail, must in all probability follow the history of other sciences.

We venture, therefore, to offer the following short and elementary exposition of those laws of lenses which will be found most useful in practice.

No mathematics beyond elementary algebra and trigonometry will be employed, and no assumptions will be made other than the law of refraction at plane surfaces and the rectilinear propagation of light. The one thing especially necessary for a clear comprehension of this subject is that each individual step shall be mastered before proceeding to the next. The following notation, essentially that suggested by Seidel,* will be used throughout.

* For Seidel's notation and many examples illustrating the simplicity of it, see Steinheil und Voit's *Handbuch der Angewandten Optik* (Leipzig, 1891). The other books which have been of most help to me are *Traité d'Optique*, Mascart (Paris, 1889), *Geometrical Optics*, Heath (Cambridge Press, 1887).

NOTATION.

1. *Small Roman* letters indicate *points*.

2. *Roman capitals* indicate *distances*.

3. *First* letters of the *Greek* alphabet indicate *angles*.

4. *Other Greek* letters indicate *physical constants*; e. g., refractive indices are indicated by μ.

5. The *medium* to which any quantity refers is indicated by an *odd subscript*; e. g., the refractive index of the second medium is μ_3, not μ_2.

6. The *surface* of separation to which any quantity refers will be indicated by *even subscripts*, e. g., the radius of curvature of the third surface of a photographic doublet is R_4, not R_3.

7. Radii of curvature are *positive* when the convex side of the surface is turned *toward the incident light*; *negative* when the convex side is turned *away* from the incident ray.

8. Lengths measured in a direction parallel to the optical axis are positive in the direction in which the light is proceeding; negative, in the opposite direction.

9. Of similar quantities belonging to any surface (focal lengths or focal points for instance), those which refer to the right hand side will be primed; *e. g.*, F'_2 refers to the right-hand side of the first surface, while F_2 refers to the left-hand side.

For the practical purposes of this paper, we need only discuss a small cone of light whose angle is such that the sine, tangent, and arc may be considered equal.

Refraction at a Single Spherical Surface.—It will be necessary to first examine the case of refraction at a single spherical *surface*, in order later to take up refraction through a spherical *lens*, since refraction through a lens consists simply of successive refractions at surfaces.

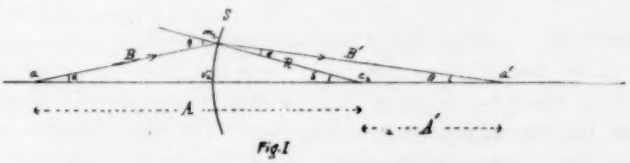

FIG. 1.—Refraction at a single surface.

Let S be a spherical surface having a centre at c_2 and containing a medium on the right whose refractive index is μ. The medium to the left, which we shall call the *first* medium, we shall take to be air, whose refractive index for our purpose may be taken as unity.

If we call v_2 the centre of the bounding surface, c_2v_2 will be the *optical axis* of the surface, and v_2 we will call its *vertex*.

Let us call R_2 the radius of curvature. According to the notation adopted, R_2 will be positive in fig. 1, where a is supposed to represent a luminous point.

We shall assume, what everyone has often proved for himself by direct experiment, that all the rays proceeding from a point, will after refraction at any number of spherical surfaces meet in a point.

Let a' be the point where the rays diverging from a meet after refraction at the surface S. Our present problem is to find a general expression for the position of a'.

Let:

$c_2a = A$, measured from c_2 towards a: in fig 1 A is negative.
$c_2a' = A'$, " " " " a': in fig. 1 A′ is positive.
m_2 = point at which any ray from a meets the surface S.
$m_2a = B$.
$m_2a' = B'$.
θ = angle of incidence.
ε = " " refraction.
δ = angle $m_2c_2v_2$.
α = " m_2av_2.
β = " $m_2a'v_2$.

Then from the triangle am_2c_2, one has

$$\frac{-A}{\sin\theta} = \frac{B}{\sin\delta} = \frac{R_2}{\sin\alpha} \quad \ldots\ldots\ldots \text{Eq. 1.}$$

and from the triangle $a'm_2c_2$, we have

$$\frac{A'}{\sin\varepsilon} = \frac{B'}{\sin\delta} = \frac{R_2}{-\sin\beta} \quad \ldots\ldots\ldots \text{Eq. 2.}$$

By definition:

$$\mu = \frac{\sin\theta}{\sin\varepsilon}$$

Eliminating sin δ from Eqs. 1 and 2, one obtains

$$\frac{-A\sin\varepsilon}{A'\sin\theta} = \frac{B}{B'} = \frac{-A}{\mu A'} \quad \ldots\ldots\ldots \text{Eq. 3.}$$

From the general properties of triangles,

$$R_2 = -A\cos\delta - B\cos\theta \quad \ldots\ldots\ldots\ldots \text{Eq. 4.}$$
$$R_2 = B'\cos\varepsilon - A'\cos\delta \quad \ldots\ldots\ldots\ldots \text{Eq. 5.}$$

From the last three equations we may eliminate the two unknown quantities B and B′, thus:

$$B' = \frac{R_2 + A'\cos\delta}{\cos\varepsilon}$$

$$R_2 = -A\cos\delta + \frac{A\,B'}{\mu A'}\cos\theta$$

$$R_2 = -A\cos\delta + \frac{A\cos\theta}{\mu A'\cos\varepsilon}\quad (R_2 + A'\cos\delta)$$

$$-R_2 A\cos\theta + R_2 A'\mu\cos\varepsilon = -A\,A'\mu\cos\delta\cos\varepsilon + A\,A'\cos\delta\cos\theta$$

$$\frac{\cos\theta}{A'} - \frac{\mu\cos\varepsilon}{A} = (\mu\cos\varepsilon - \mu\cos\theta)\ \frac{\cos\delta}{R_2} \quad . \ . \ . \quad \text{Eq. 6.}$$

In this last equation, we have a general expression which serves to determine the position of the point a' in terms of the position a. It will be observed, however, that for any fixed position of a, the position of a' varies with the angle δ, or, in other words, the aperture of the surface.

In order to avoid the discussion of this variation of focal length (*spherical aberration*, as it is called), we shall consider the lens stopped down very small.

In the limit, which is practically reached in a stop of F-32 or F-64, the point m_2 in fig. 1 coincides with v_2,

$$\delta = 0$$

and

$$\cos\delta = \cos\theta = \cos\varepsilon = 1.$$

Eq. 6 then becomes

$$-\frac{\mu}{A} + \frac{1}{A'} = \frac{\mu - 1}{R_2} \quad . \ . \ . \ . \ . \ . \ . \ . \ . \ . \ \text{Eq. 7.}$$

This gives us A′ in terms of the two measurable constants μ and R_2, and in terms of the distance of the luminous source A′.

The important thing to remember in the use of this equation is to give A and R_2 their proper signs, and to interpret A′ according to its sign. When A′ is positive the image is on the right of the centre C_2; when A′ is negative the image is to the left of the centre C_2. When this convention of signs is regarded there is no possible ambiguity in the equation.

Since this equation is of the first degree in A and A′, it is evident that for any one value of A there will be but a single value of A′. The converse of this is likewise true. Therefore all the rays which intersect in a' must intersect in a. This is equally true whether a is the image or the object.

Definition.—Two such points, viz., points the rays from either one of which after refraction intersect at the other, are said to be *conjugate points*.

If the positions of the conjugate points are measured from the vertex, instead of from the centre of the surface, Eq. 7 will take a similar but more useful form.

Let P_2 and P'_2 denote the respective distances of a and a' from the vertex of the refracting surface, v_2 in fig. 1.

Then

$$P_2 = A + R_2$$
$$P'_2 = A' + R_2$$

Eq. 7 then becomes

$$\frac{1}{P'_2 - R_2} - \frac{\mu}{P_2 - R_2} = \frac{\mu - 1}{R_2}$$

which transforms into

$$\frac{\mu}{P'_2} - \frac{1}{P_2} = \frac{\mu - 1}{R_2} \quad \text{. . . . . Eq. 8.}$$

In refraction at a spherical surface, there are

Three Interesting Pairs of Conjugate Points.

The *first* of these is that where the luminous point is at an infinitely great distance to the left, the incident light is then parallel ; the point conjugate to this is then known as the *second principal focus*, and the distance of the conjugate point from the vertex is known as the *second focal length*.

When the luminous point is in such a position that the conjugate point is at an infinite distance to the right, the luminous point is said to occupy the *first principal focus*, and the distance of the luminous point from the vertex is called the *first focal length*. Each of the focal points is, therefore, conjugate to a point at infinity.

The two planes which are perpendicular to the optical axis and pass through the first and second principal foci respectively are called the *first* and *second focal planes*.

To determine the *second* focal length, let

$$P_2 = -\infty$$

then Eq. 8 becomes

$$[P'_2] = \left(\frac{\mu}{\mu - 1}\right) R_2 = F'_2, \text{ say} \quad \text{. . . . . Eq. 9.}$$

F'_2 being a special value of P'_2 obeys the same rule of signs ; it is positive, therefore, when the second principal focus is to the right of the vertex ; and negative when to the left.

It will be observed that when R_2 becomes zero, negative or infinite, that F'_2 also becomes zero, negative or infinite, and again when μ

changes from a quantity larger than unity to one smaller than unity, then F'_2 changes sign.

To determine the *first* focal length, let

$$P'_2 = +\infty$$

then

$$[P_2 =] \quad -\frac{R_2}{\mu - 1} = F_2 \text{ say} \quad . \quad . \quad . \quad . \text{ Eq. 10.}$$

It is important to note that these two focal lengths are not equal, but that

$$\frac{-F'_2}{F_2} = \mu \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \text{ Eq. 11.}$$

and

$$F'_2 + F = R_2 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \text{ Eq. 12.}$$

For concave surfaces R_2 is negative; F_2 therefore becomes positive and F'_2 negative. By introducing the values of F_2 and F'_2 we may write Eq. 8 thus

$$\frac{F'_2}{P'_2} + \frac{F_2}{P_2} = 1 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \text{ Eq. 13.}$$

So far, we have measured our lengths from only one point at a time. In Eq. 7 this point was the center of the spherical surface; in Eq. 8 it was the vertex of the surface. But to put this fundamental equation in the simple and elegant form used by Newton,* the position of the *luminous* point must be measured from the *first* principal focus and the position of the *conjugate* point from the *second* principal focus.

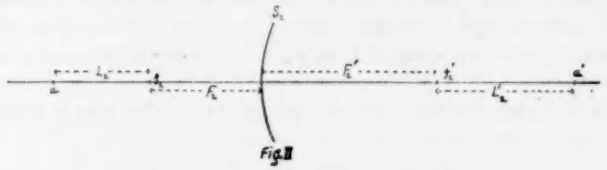

FIG. 2. Illustrating Newton's Rule.

Let us call f_2 and f'_2 the *positions* of the first and second principal foci respectively, and the distance of the luminous point from f_2 call L_2; and the distance of a' from f'_2 call L'_2, then

$$L_2 = P_2 - F_2$$
$$L'_2 = P'_2 - F'_2$$

Note that L_2 is positive when a is to the right of f_2, and negative when a is to the left of f_2, as in fig 2.

*Newton, *Opticks.* Third Edition (London, 1721), p. 9.

Eq. 13 now takes the form

$$\frac{F'_2}{L'_2 + P'_2} + \frac{F_2}{L_2 + F_2} = 1.$$

or $$L_2 L'_2 = F_2 F'_2 = \frac{-\mu}{(\mu - 1)^2} R_2 \quad \ldots \text{Eq. 14.}$$

Since $F_2F'_2$ is essentially a negative quantity, it will be seen that if L_2 is measured to the *right* of the *first* focus, L'_2 will be measured to the *left* of the *second*, and *vice versa*. As the point in the first medium approaches f_2, the point in the second medium recedes from f'_2, in such a manner that the product of their respective distances is a constant. Note that f_2 and f'_2 are not conjugate points.

Second Pair of Remarkable Points. In this one of the points, and, therefore, also its conjugate, is at the vertex.

This is evident from Eq. 14 where if $L_2 = -F_2$, $L'_2 = -F'_2$. The vertex, therefore, possesses this remarkable property, that it possesses at the same time both image and object. To such points, in general, Listing has given the name *symptotic*.

These points are frequently met with in practice, *e.g.*, in determining the magnifying power of a microscope, by bringing the image to focus in the plane of the object.

Third Pair of Remarkable Points.—This pair is made up of two points which coincide at the centre. For, as will be seen from Eq. 7, when $A = o$, then also must $A' = o$.

Here also object and image coincide: but this point possesses the additional property that all rays of light directed towards it or radiating from it *pass through the surface without deviation.* This pair of points will assume great importance later when we come to the treatment of of lenses.

Case of Luminous Point not on Optical Axis.—Let b be a luminous point, not on the optical axis, and b' its conjugate.

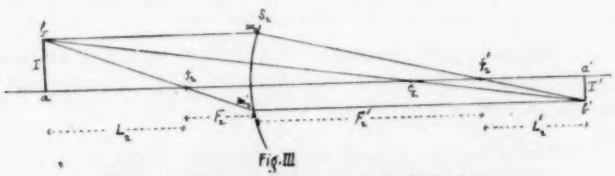

FIG. 3. Luminous Point not on the Optical Axis.

It will be seen that the point b' must lie on the straight line through bc_2 and the distance of b' from c_2 may be computed directly from Eq. 7.

Or the position of b' may be determined geometrically, thus:

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JULY, 1891.

FAC-SIMILE OF THE FIRST PORTRAIT MADE BY THE DAGUERREOTYPE PROCESS IN THE WORLD. TAKEN BY ROBERT CORNELIUS IN PHILADELPHIA, NOVEMBER, 1839.

NEGATIVE FROM ORIGINAL BY
JULIUS F. SACHSE.

HALF-TONE BY
PHILA. PHOTO-ENG. CO.

Draw the ray bm_2 parallel to the optical axis; after refraction at the surface S_2, this ray must pass through the second principal focus, f'_2; its direction in the second medium is, therefore, determined. In like manner, draw the ray, bf_2, through the first principal focus; after refraction at m'_2, it will take the direction m'_2b', parallel to the optical axis; its direction in the second medium is, therefore, determinate. The point b_2 at which these two rays intersect will evidently be the image of b. In the same manner, any point lying between a and b will give an image lying between a' and b': so that the line ab will have for its image the line $a'b'$. But the most useful method of defining the position of b' is to give the perpendicular distance from a and then give the distance of a' from the vertex, thus:

Let $$ab = I$$
and $$a'b' = I'$$

We proceed to find I′ in terms of known quantities. Distances measured from the optical axis downwards are called negative; those upwards are called positive. We have, therefore, fig. 3, from similar triangles,

$$\frac{-I'}{I} = \frac{F_2}{L_2} = \frac{L'_2}{F'_2} = \frac{\sqrt{F_2 L'_2}}{L_2 F'_2} = \frac{\sqrt{-L'_2}}{\mu L_2}$$

or, $$\frac{-I'}{I} = \frac{P'_2 - F'_2}{F'_2} = \frac{F_2 P'_2}{F'_2 P_2}, \text{ by Eq. 13.}$$

This may be written thus:

$$\frac{+ I' F_2}{P'_2} + \frac{I F_2}{P_2} = 0 \quad \ldots\ldots\ldots \text{Eq. 15.}$$

So soon as the distance of an object from the vertex and the focal lengths of the surface are known, the computation of the position and size of the image from Eqs. 13 and 15 becomes a simple matter.

Reflection a Special Case of Refraction.—It is interesting to note that all the formulæ relating to mirrors, plane, convex, or concave, may be derived from the immediately preceding by giving to μ the value, —1.

The particular value, unity, indicates that the angle of incidence is equal to the angle of refraction, and the minus sign shows that the ray comes backward, instead of going forward.

For instance, from Eq. 9 one sees that the focal length of a concave mirror of radius $-R_2$ is

$$F' = -\frac{R_2}{2}$$

likewise from Eqs. 9 and 10, that

$$F'_2 = F_2$$

(*To be continued.*)

EARLY DAGUERREOTYPE DAYS.

AN HISTORICAL REMINISCENCE.

STRANGE as it may seem at the present day even the publication of this demonstration at first attracted but little attention in America, the matter not being taken seriously by the general public, while the scientific men of the day were, if possible, even more shy of the apparently minute description of Daguerre's invention, as many of them were yet smarting under the ridicule heaped upon them by their acceptance as truth of Locke's imaginary account of Sir John Herschel's lunar discoveries, with a forty-two-thousand power magnifier.

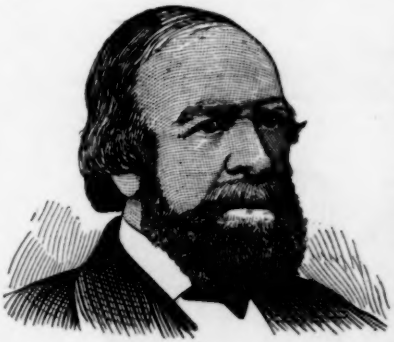
How slow they were in accepting this published account as truth, is shown by the fact that no notice whatever was taken of the subject at the Stated Meeting of the American Philosophical society at Philadelphia, held October 18th, 1839, then one of the most active scientific organizations in America. While at the Wistar party, held on the next evening, Saturday, October 19th, at the house of Job R. Tyson, southwest corner of Fourth and Prune streets, all persons present being members of the American Philosophical Society, the matter was brought up as another grand hoax, similar to the one mentioned above, which had so sadly been imposed upon many present.

In fact, one of the leading members present, a professor in the University of Pennsylvania, relieved himself of a lengthy opinion in which he characterized the whole matter as not only improbable, but an impossibility, and in conclusion pronounced the whole report a ludicrous fabrication of some great wag or the emanation of a lunatic's brain. This opinion of the learned professor was concurred in by all the scientific philosophers present.

Joseph Saxton.

Among those whose notice was attracted to the publication was one Joseph Saxton, an attaché of the United States Mint in Philadelphia, a man of culture and great scientific accomplishments. When Mr. Saxton read the account in Poulson's *Adver-*

tizer,* it seemed so clear and feasible that he at once concluded to try the process according to the directions as set forth in the newspaper.



Jos Saxton

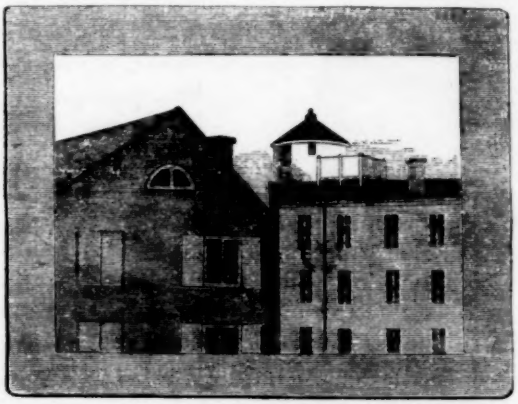
From Photograph by Brady, in Album of American Philosophical Society.

A segar-box was improvised as a camera, while an ordinary burning glass, consisting of a convex lens, was fixed in at one end and made to do duty as an objective. A paste-board Seidlitz powder box, containing some flakes of dry iodine, and a cut-out in the lid somewhat smaller than the plate, answered all purposes of a coating box. For a mercury bath the ingenious experimehter mortised a block of hard wood, attaching underneath a globular bottom of sheet iron, so as to hold the quicksilver and allow the application of a spirit lamp beneath. A piece of polished silver ribbon one and one-quarter by two inches, such as coin blanks are cut from, served in lieu of the copper plates.

When all preparations were completed the ingenious Saxton set his apparatus on the window sill of one of the second story north windows of the mint, and pointed it northeastward towards the sunlit buildings beyond. After the exposure the instructions in the newspaper were followed to the letter amidst the ridicule of the other attachés who were present, but to the great surprise of the latter and joy of the experimenter, the attempt resulted in a perfect picture. There, permanently impressed upon the silver plate, was the picture of the old Philadelphia High School and the State Arsenal, which then stood upon the site.

* An old member of the Philosophical Society who was active at that time claims that Saxton's experiment was made a month previous (September, 1839), shortly after the letter to A. D. Bache, above quoted, and before it was published. Careful investigations by the writer, however, seem to point to the latter date, October 16th, 1839, as the correct one.

Joseph Saxton had proved the truthfulness of the published account of Daguerre's invention, and had made the first heliograph in America of which we have a positive knowledge.



Original now in possession of Historical Society of Pennsylvania.

On the next day Saxton succeeded in making several other pictures of different buildings, all taken from the same window.

Joseph Saxton was a native of Pennsylvania, and a born mechanical genius; in scientific attainments he had few superiors, while in the higher mechanics he stood without an equal.

At the time when the advices of Daguerre's process reached America, Joseph Saxton, who was by profession a scale maker, was connected with the weighing and assay department of the United States Mint, at Philadelphia, where a *chef d'œuvre* of his skill may still be seen in the assay office. This consists of a pair of scales for analytical purposes; the beam is of palladium, and so accurately is the instrument balanced that one-tenth of a milligram (.00154 grain Av.) turns the beam, and this after half a century's use. He also invented a medal-ruling machine, which he exhibited in London about the year 1829. This ingenious device he afterward perfected and improved so that it would copy a medal or coin automatically by steam power. So rapid and true did this device work that a disk of a coin an inch in diameter was

engraved in half an hour, the number of lines traced counting two hundred to an inch.

Specimens of the marvelous results obtained by this machine, which are not even surpassed for fidelity to the original by any photographic process of the present day, may be seen in *The Manual of Gold and Silver Coins of all Nations*, by J. R. Eckfeldt and W. E. Du Bois, *Philadelphia, 1842*. The book is to be found in all large libraries.

Joseph Saxton was also a pioneer in the art of galvano-plasty, and was the first person to practically apply the electro-galvanic process for the mechanical reproduction of photographic impressions.

About the year 1843 this ingenious mechanic was called to the National Department of Weights and Measures at Washington, where he remained until his death, Oct. 16, 1873.

Saxton's heliographic results, upon being shown to interested parties, at once created a great stir in scientific circles, one of the first effects being the publication in the *Journal of the Franklin Institute* (November, 1839), of an original translation from the French of Daguerre's process by Professor J. F. Frazer, who also succeeded in producing a daguerreotype from this description, viz.:

> Practical description of the process called *Daguerre*, which consists of the spontaneous reproduction of the images of natural objects, in the *camera obscuro*, not with their colors, but with great delicacy in the gradation of tints, by Daguerre.

The scientific fraternity was now thoroughly aroused. Many who at first received the whole matter as another huge hoax, and left no opportunity pass to ridicule the published accounts, now became most enthusiastic advocates. Theories multiplied daily, but with all this the time of exposure was not yet brought within the demands for portraiture. Here again we find a practical man with the aid of common sense accomplishing that which theoretical scientists held to be next to impossible.

Robert Cornelius.

To Robert Cornelius, of Philadelphia, is due the honor of having produced the first successful portrait of a living person by

the Daguerre process. This was accomplished in the yard back of his store and residence, [old] 176 Chestnut Street, above Seventh (new number 710), in Philadelphia.

How Robert Cornelius, who was a lamp-maker and a metal worker, became interested in Daguerre's invention, is best told in his own words to the writer, viz.:

"Mr. Saxton, who was then connected with the United States Mint, had the opportunity of receiving an early notice of the manner in which Daguerre was operating. He very soon produced a picture from the second story of the mint,—a view of chimneys and tops of houses. He was anxious to continue the experiment, and called upon me, and showed his experiment, and explained to me the manner of doing it, and desired me to prepare some plated metal to experiment with. With pleasure I complied with his request. It was our business to make a great variety of articles of plated metal (copper coated with silver). Very soon afterwards I made in the factory a tin box (and boxes, according to Saxton's description), and bought from McAllister, No. 48 Chestnut Street (now 206 Chestnut Street), a lens about two inches in diameter, such as was used for opera purposes (called achromatic). With these instruments [*i.e.*, a tin box for a camera, and this lens.—ED.] I made the first likeness of myself (see frontispiece), and another one of some of my children*, in the open yard of my dwelling, sunlight bright upon us, and I am fully of the impression that I was the first to obtain a likeness of the human face" [by the Daguerre process.—ED.].

In a subsequent communication in reference to this picture, Mr. Cornelius writes:

"You will notice the figure is not in the centre of the plate. The reason for it is, I was alone, and ran in front of the camera after preparing it for the picture, and I could not know until the picture was taken that I was not in the centre. It required some minutes with iodine to produce the effect."

Unfortunately the exact date of this successful experiment at portraiture has not come down to us, nor is Mr. Cornelius able to recall it to a certainty. That it was not long after Saxton's experiment is however proven by the fact that one of the pictures was shown by Dr. Robert M. Patterson, a director of the

* This second picture is still in existence.

Mint, at the regular stated meeting of the American Philosophical Society, December 6th, 1839, and the fact is so recorded upon the minutes (Proc. A. P. S., Vol. 1, 155).

It was not until a month after this exhibition, December 6th, 1839, of Cornelius effort, that the first French Daguerreotype reached America. This was obtained in Paris by Mr. Henry Seybert and sent to the American Philosophical Society, it was shown at the regular meeting, January 3d, 1840 (Proc. A. P. S., Vol. 1, p. 169).

A comparison with Saxton's early efforts showed that they were equal if not superior to the French specimen of that early day, while Cornelius' and Goddard's efforts were far in advance of the French production.

THE FIRST STUDIO.

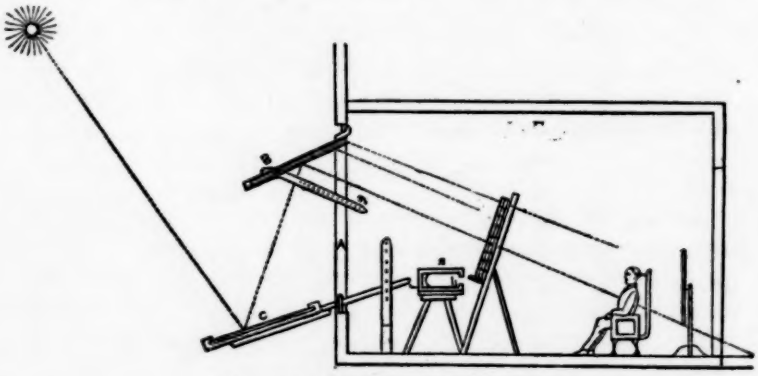
Spurred on by his success in portraiture, Robert Cornelius now devoted considerable time to heliographic experiments, and the perfection of the process for protraiture. These progressed so satisfactorily that early in the year 1840 the second-story room in the building at the northeast corner of Eighth Street and Lodge Alley (now Jayne Street), above Chestnut, was secured and arranged for Daguerrean portraiture, the first heliographic studio in America.

The method employed to concentrate light upon the sitter, consisted in a series of reflectors set at different angles, together with the use of blue glass to screen the sitter. The time for a sitting averaged about one minute. The plan of this arrangement is reproduced in the accompanying cut.

A, the window with sashes removed. *B* and *C*, large looking-glasses mounted as plain reflectors, the lower one (*c*) having rotary motion upon the saddle, resting upon the sill of the window in order to direct the rays upon the reflector (*B*) at any hour of the day—the vertical motion of the reflector *c* being necessary, the sun varying in altitude so much during the hours most favorable to the production of portraits. The lower reflector was kept in the required position by a lever, upright post, and bolts. The upper reflector was hinged at its upper end at the top of the

window frame, the only motion necessary being that which would reflect upon the sitter the incident rays from the lower reflector,—the reflector *B* being kept at the required angle by the connecting lever *m*.

In front and between the sitter and the reflector, upon a proper stand, a screen was placed to protect the eyes of the sitter. After a short time this was replaced by Mr. Cornelius by a screen of blue glass suspended from the ceiling. This screen was another



Plan of the first photographic studio.*

example of the operator's ingenuity. At that early day no glass of sufficient size was to be had, so a quantity of ordinary blue window glass was obtained and holes drilled through the corners, and several sheets were thus wired together to increase the size, and when complete was suspended from the ceiling in its proper place, and so arranged that when a person was sitting this glass screen could be moved to and fro, the object being to prevent shadows on the face of the sitter produced from the uneven surface of the glass.

It is an interesting fact that the necessary apparatus, such as cameras, plates, mats, coating, boxes, &c., was all made by Mr. Cornelius personally. The lenses were imported or made for him by McAllister, the Philadelphia optician.

In connection with this matter we reproduce a copy of the first successful studio picture, the father of the writer, taken by Mr. Cornelius, in his new establishment. It is a representative

* Footnote will appear in a future number.

specimen of his skill and proficiency, and the perfect condition of the miniature attests the permanency of his early efforts.

Considerable success attended Mr. Cornelius with his new equipment, a leading feature being an increase in the size of the image. Thus on March 6th, 1840, we again find a notice of his progress chronicled in the Proceedings of the Philosophical Society; viz.:—

"Dr Patterson exhibited some specimens of the heliographic art (Daguerreotype) of a large size, executed by Mr. Robert Cornelius, of Philadelphia, and stated to the Society that Mr. Cornelius had succeeded in obtaining beautiful representations upon highly-polished silver plate." (Proc. A. P. S., Vol. 1, p. 181.)

Daguerrean protraiture in Philadelphia was now an established fact, and it is a matter worthy of record that the first paying sitter was John McAllister, the leading optician of Philadelphia, whose establishment was then at No. 48 (No. 206) Chestnut Street, and who had furnishsd the lenses for all the early investigators.

Daguerrotype Miniatures.

Mr. Cornelius' enterprise attracted much attention among the wealthy and scientific classes, and brought many sitters to the establishment.

An interesting item for the professional of to-day, who furnishes a dozen cabinets for a dollar, or who turns out thirty-six tintypes for a quarter, is, that so great was the rush for the Daguerreotype miniatures, as they were then called, that prospective sitters had to be "booked" a week ahead at $5.00 for each sitting. Each received their day and hour, subject of course to sunshine. No pictures were attempted in cloudy weather.

It is stated that the total time consumed to turn out a finished *Daguerreotype miniature* was ten minutes; this included one minute for exposure.

Some of the larger pictures yet in existence were mounted in ornamental brass frames, which were cast, chased and lacquered, and intended to hang against the wall similar to an ordinary painting.

Another curious custom was that when a clergyman wanted

his miniature with a white neck-kerchief he was requested to substitute a bright blue silk for his snow-white cambric, as blue always came out white, but white often came out blue, and to insure success a substitution was always recommended or insisted upon.

The same course was pursued when a lady wanted to appear in a white or bridal costume.

Just how long Robert Cornelius continued in the Daguerreotype business commercially is difficult to determine to a certainty, but it is thought not to have extended much over two years.

About a year after the "Atelier" at Eighth and Lodge Alley was established, Mr. Cornelius removed his establishment to larger quarters on the south side of Market street, six doors above Eighth street. His public announcement of this fact sets forth, viz.:—

"DAGUERREOTYPE MINIATURES.—R. Cornelius respectfully announces that he has resumed the taking MINIATURES, and invites the public to call at his rooms, No. 270 MARKET ST. (now 810), where specimens of the art can be seen. The recent improvements are such that miniatures can be made in the shade and without regard to the state of the weather. j 16. 1ms."

Public Ledger, July 1st, 1841.

The last positive record we have relating to Cornelius as a professional heliographer is the entry upon the minutes of the stated meeting of the Am. Philosophical Society, April 15th, 1842, stating:—

"Mr. G. W. Smith presented some Daguerreotype portraits made by Mr. Cornelius by an improved process, an important part of which was the greater polish given to the plate, and the absence of cross lines."

To prepare the highly polished Daguerreotype plate so that the surface should be free from the annoying cross lines, such as appear upon the specimen of early studio portraiture which we reproduce, was the great aim of all the experimenters in heliography. As is shown by the above report, Cornelius was the first to overcome this difficulty, and the improvement was counted of sufficient importance to present to the Philosophical Society.

It was Mr. Cornelius' knowledge of working metals and pro-

fessional skill in polishing silver plate, together with Dr. Goddard's chemical discovery which accounts for the great superiority of his early Daguerrotype miniatures.

When Mr. Cornelius finally retired from this enterprise it was for the purpose of devoting all of his time to his legitimate business, which was then assuming large proportions, through the more general introduction of illuminating gas, which brought about an increasing demand for gas fixtures. Mr. Cornelius, however, still maintained his interest in Daguerreotypy, and lost no opportunity to advise and instruct others. In a note to the writer covering this ground he states:—

"When I ceased the business I closed it, and did not sell out to any one. I instructed (gratuitously) very many persons, some of whom commenced business on their own account."

Among the parties so instructed by Mr. Cornelius, was the late Marcus A. Root, who for many years was one of the foremost Daguerreotypists in the United States. One of the great points of the Root pictures, in which they excelled all others, was the exquisite polish of the plates, a process imparted to him by Mr. Cornelius. (*To be continued.*)

ADVICE TO LANDSCAPE PHOTOGRAPHERS.

XANTHUS SMITH.

IT is an excellent motto that anything that is worth doing, is worth doing well, and one that applies particularly in photography.

If we would always follow the rule that we should give full consideration to the matter of taking a picture, we are quite sure that there would be many more excellent photographs in existence, and infinitely fewer bad ones. In our eagerness to secure a portrait or a view, how often do we fire away at haphazard at our subject, trusting to luck for a fortunate result from our attempts, when we should really have proceeded cautiously, weighing and considering and looking upon our subject with a

careful eye, as to what its appearance would be in the finished print.

In the pursuit of landscape photography we probably find more careless work than in any of the other branches. The reason for this is, that our subjects are so much less under control in the manner of arrangement and lighting than are indoor groupings, and in addition we are so much at the mercy of the weather in out-door work, that it is no wonder that we often make attempts, when we had far better leave the work undone.

When we take fully into consideration what really constitutes the most favorable conditions for landscape photography, and how seldom these conditions actually pertain, we almost become disheartened at the very outset from attempting a branch of photography which must on the one hand give us many spoiled plates and unsatisfactory prints, or on the other an exceedingly small number of really good and valuable works, secured at cost of much pains and a very great deal of time.

Let us inquire what are the most favorable conditions for landscape photography? A considerable amount of atmosphere certainly, varying with the range of our view; as, if our scene embraces an extended distance, of course the prevailing haziness should be much less than in more confined views. When our scene is much shut in, and the nearer portions form the principal object of our picture, a very great amount of haziness will often enhance the beauty of our work very much, by subduing the further portions, giving relief to the nearer, aiding the perspective, and altogether adding to the sentiment of the work by giving a certain amount of mystery.

Flying clouds are indispensable to the perfect rendering of many extended landscape scenes. The broad shadows which they cast upon certain passages give relief, and make the picture effective, as painters say. To secure the true value of these passing shadows, it is necessary to study the scene to be depicted for a considerable time, in order that we may determine which of the passages of our scene should be subdued or merged in shadow, and which remain in clear sunshine. By securing the

happy moment for the exposure of our plate we will convey the time at which the most objectionable lines in our picture are lost in shadow and the most graceful and harmonious brought out in bold relief.

Any good landscape subject deserves a number of visits prior to an attempt at portrayal of it, simply to determine what are the most favorable conditions of light and shadow, that is direction of light, not only as to whether the sun's rays should strike from the right or the left; but whether a high and brilliant illumination is preferable to that of a declining sun with extended shadows, the latter giving more breadth and sentiment, and the former more brilliancy of effect.

Serenity of atmosphere. What can we do in landscape photography with a constantly disturbing wind blowing? Really nothing, when foliage constitutes any portion of our work. Here the instantaneous shutter avails us nothing. The most perfect rendering of foliage necessitates a large amount of detail in the shadowed portions, which is only got by a snfficiently long exposure to impress the under passages, from which the direct light is cut off by over-tapping boughs. The stems and inner portions of trees when in shadow are much the same in regard to lighting, as objects in ill-lighted apartments, and the range is so great between these portions and the brilliant reflected lights upon outer masses of glossy leaves, that it is only the most careful exposures that can produce a harmonious rendering of beautiful foliage.

It is in vain that we attempt to make our exposures by uncapping and capping during the lulls and puffs of wind in working in windy weather, for even if we have the good luck to catch a comparative calm, we are sure to find, on developing our plate, that some portion of our picture is blurred, and most likely in the foreground, where the securing of crisp definition would most have enhanced the beauty and value of our work. We all know, too, how the charms of most landscape views are enhanced by passages of water, and above all by reflections, which by doubling the features composing the shore line, add fulness and interest,

and act as supports to their masses of light and shadow, all of which we are completely debarred from getting in windy weather, when the surface of the water is so disturbed that we have nothing in its place in the photograph but a harshly cut out white patch, destroying the unity and tone and sentiment of the picture. Generally also, in windy weather, the atmospheric haze is carried away, and consequently the aerial perspective. The advantage of working during the prevalence of a considerable amount of atmosphere is too little appreciated in this country.

There is no doubt but that the English photographers excel us Americans in landscape photography, and mainly for two reasons, the first being their appreciation of atmospheric effects, which is no doubt a result of their moist climate, and the second the extreme pains which they are willing to take in order to secure an effective picture.

In this country we are too prone to work on excessively clear days, when the atmosphere is robbed of moisture and the aerial perspective is utterly destroyed. Such days are the ones upon which the majority of people most admire views, because everything is distinctly revealed to the eye from the foreground to the extreme distance; but they are not the days for making artistic pictures, as we have neither perspective nor sentiment, two of the most important qualities in landscape pictures.

So aware are the English of the necessity of aiding the perspective in conveying a scene upon a flat surface, that in addition to the softening effect produced upon the more distant portions of a view by mistiness in the air, or when such condition does pertain to a sufficient extent, they use much larger stops in order, by blurring the distance, through inaccuracy of focus, to drive it off, as it were, and thereby secure an emphasis and consequent advancement of the foreground passages. Then Englishmen, or at least those who furnish us with the best landscape work, do not go off for a day and fire away a dozen or more plates, and hurry home to develop them the same evening, when fatigued, though impatience to see the result of the day's work. In contrast to this we have heard of a man, in Scotland, trying and

waiting for years before he succeeded in getting successfully a view which he was anxious to secure, under the most perfect conditions of lighting and effect; and we know of those who, having secured a few careful exposures during the summer, have spent much of the following winter in developing and printing them. Such is not only the way to attain a high standard of excellence in anything, but also to make it instructive and improving to ourselves and to others.

Not that we would recommend a cautiousness of procedure altogether equalling the extreme ones to which we have just referred, because such a method, while a part as it were of John Bull's very being, is altogether incompatible with our American go-ahead temperament, and then in the matter of photography the element of luck, we cannot deny, plays so important a part that we may often venture exposures of plates even when the conditions appear to be very unfavorable. We all know how some chance shot, from which we have expected nothing, will give us one of our most successful pictures. Let us enjoin, though, a large share of time and pains and consideration, to landscape photographers. The higher we aim the better, for if we do not always attain the success which we have conceived possible to us, the standard of excellence of our work will certainly be far above that of the careless, hurried worker, who does not consider his pursuit worthy either of the time or the pains which it deserves.

SOME CONDITIONS OF INFLUENCING THE WELFARE OF PHOTOGRAPHIC SOCIETIES.*

BY W. H. HARRISON.

A photographic organization may be prosperous in its intellectual capacity, as it may be prosperous in its funds and the number of its members; it may also be prosperous in both. When it is but materially rich, a local society may go quietly and comfortably on its way, and be little esteemed outside the

*Read before the Clapham Camera Club.

limits of its own parish; when, however, its intellectual powers add considerably to the progress of photographic art and science, its discoveries attract the attention of the world.

That a local society should raise itself above the dead level of the general run of such organizations, it is necessary that each individual member, when time and opportunities permit, should take up some special work, and afterwards place the results before the whole body of the members. In reading the records of the average proceedings of local photographic societies, one would suppose that none but silver and a few other processes existed, and that we have nothing to talk about at our meetings but the working of common processes connected with the plates, films, and papers ordinarily sold in commerce. What is wanted is, that one member shall say, "I will carry on novel photographic researches with the salts of iron;" that another shall resolve to do the same with uranium salts; that others shall experiment with the salts of nickel, cobalt, and other metals; that one member shall take up the primuline process and discover its possibilities, and so on, so as to get away from the mere common processes, and to discover new things about the others. We should also have men quitting the beaten track in matters artistic. The finest artistic effects in photographic printing are, I think, produced by Klio's—better known as the "photogravure"—process, yet where is the amateur who works the same? Dr. Emerson announced his intention of beginning to work at it, but I have not yet heard of the results.

I do not believe in appointing committees to conduct such investigations from a pious sense of duty, and a mere belief that the work ought to be done. It is for the individual to strike out new paths, not as a task, but as a pleasure; it is for each of our younger members to resolve to no longer live as a nonentity, but to do something to increase the store of human knowledge, and to stand out as a benefactor of the race.

What dreary reading is to be found in the local society reports in the photographic press! We are, perhaps, informed therein that Mr. Jones sat down amid loud applause after reading a

valuable paper—in which the reporter can find nothing worth printing. Sometimes we are told how J. Smith, Esq., J. P.—a man knowing nothing of photography—honored the photographic society of Little Pedlington with his presence, and how all the members grovelled before him. I think that the editors of all photographic papers will thank me for speaking of the lack of general interest and of useful information in the average reports of the local societies; they cannot well leave the reports out, because their circulation might then fall in the various localities. Let, then, some of the energetic young men connected with this Club bring in some results of original research, and make the reports of our proceedings worth reading.

THE SPRING MEETING OF THE LEOPARDVILLE CAMERA CLUB.

Editor AMERICAN JOURNAL OF PHOTOGRAPHY:

After an absence of several months I have again returned to my native heath, and once more venture to inform you of local photographic happenings.

In my search for an item of interest I dropped in at the spring meeting of the Leopardville Camera Club. To my surprise, I hardly recognized the former society. A change had come over the same since my last visit several months ago,—discontent and despondency reigned supreme where formerly joy and happiness were enthroned. Sadness and gloom overspread the faces of the members who were usually so smiling and happy,—despair and disappointment were impressed upon the countenance of the genial secretary, while several of the other officers, heretofore so affable, were dejected and melancholy.

All seemed to indicate that some great calamity had overtaken the club, yet a close inspection showed the presence of the treasurer, and failed to note an empty chair throughout the room.

Even after the meeting was called to order, no life or spirit was manifest in the proceedings. The secretary read his minutes without the usual snap, and even the president's approving nod was slow and sad.

When finally the committee reports were reached, the cause of this lugubriousness became apparent.

In an evil hour the club had resolved to participate in a joint exhibition with two sister clubs of other towns, the exhibition to be held at Beanville, under the auspices of the Beanville Hypo Club, the judges of awards to be Moses Pumpernickel, Raphael McAngelo and J. Emerson Trotter,—three artists of reputation in their special lines of art.

Great were the preparations made for this display by the little coterie of the club, to whose lot invariably fell the honors of the local exhibitions.

The thought that they might be ignored in the distribution of awards was never for a moment a matter of consideration, at all the various displays of the club the interested few invariably took the honors, as it was a foregone understanding for whom the votes were to be cast.

At the combined show, however, the case was different; the artist committee, Messrs. Pumpernickel, McAngelo & Co., failed to become impressed with the importance of the social magnates of the Leopardville Camera Club, and by the adoption of similar tactics awarded the chief prizes to members of their own club and their friends, thus ignoring almost entirely the expectant and self-confident Leopardites.

It was a few days prior to the spring meeting when the account of the Beanville committee's action reached Leopardville. As a sequence, loud and deep were the anathemas heaped upon the Beanville Club. It was this incident which cast the green fog of despair over the developing expectations of the flower of the Leopardville Camera Club upon the night of the meeting.

After the report was read before the society, considerable discussion ensued, in which Pumpernickel & Co. came in for the lion's share of abuse; the usual charges of fraud, partiality, venality, etc., were indulged in.

It was all to no purpose, however, there was no appeal; Beanville had the medals, while Leopardville, with the exception of a few worthless crumbs, was ignored.

An attempt was made to heal the wounded feelings of the dis-

appointed exhibitors by showing that Pumpernickel was in fact only a calciminer, McAngelo a sign painter, and Trotter a house decorator and grainer, and that not a single one of the committee could tell the difference between a silver-print and a photo-lithograph, yet all this did not give them a medal.

Several denunciatory resolutions were also proposed and seconded, but failed, as they were not vindictive enough nor strong enough in expressed contempt towards the Beanvillians.

When the meeting finally adjourned, it was quietly agreed upon not to publish the minutes of the proceedings of the night, as it would only put upon record the discomfiture of Leopardville's photographic magnates, around whom the whole club is supposed to revolve. —J. Focus Snappschotte.

PRELIMINARY ADDRESS OF THE COMMITTEE OF THE WORLD'S CONGRESS AUXILIARY ON A CONGRESS OF PHOTOGRAPHERS.

THE World's Columbian Exposition of 1893 is intended to commemorate the progress of civilization, and be an incentive to further development, not only by displaying the best products of men's thoughts, as shown in material things, but also by bringing together for conference, in a series of Congresses, the leading thinkers, workers, and artists of the world. The World's Congress Auxiliary has been organized with the approval and support of the Exposition authorities, and of the Congress of the United States, to have general charge of these Congresses. Audience rooms, sufficient in number and capacity, will be provided by the Directory of the Exposition.

Among the Congresses of the Columbian Exposition of 1893, that to photography should rank high and be, as it undoubtedly will, a permanent benefit to the civilized nations of the earth. The advancement that has been made in photography, and the processes dependent upon it, within the last twenty years has astonished the artists and scientists of the world. By its aid, the astronomer has discovered countless stars and remodeled the map of the starry heavens. It is extensively used in almost every de-

partment of art, literature, and science. Its future possibilities are too great for any one to estimate.

It is the design of the Committee to have men and women, who have become distinguishnd in the various departments of the photographic art, and the processes dependent upon it, deliver papers before the photographic congresses which shall contain their best thought, and after well-regulated discussions, shall become the property of the World's Congress Auxiliary, and if deemed worthy, be published in the Encyclopedia of proceedings.

The following are suggested as some of the topics which may appropriately engage the attention of the Photographic Congress:

The History and Development of Photography, The Present and Future Possibilities of Photography, Emulsion Photography, Photographic Chemistry, Microscopic Photography, Portrait Photography, The Production of Photographs in Natural Colors, Photographic Apparatus, Landscape Photography, Photographic Mechanical Processes, The Best, Cheapest, and Most Rapid Photographic Process for Illustrating Books, Newspapers, etc.; The Latent Image and Its Development, Photo Legal Photography, Photo-Medical Photography, Astronomical Photography, Amateur Photography, Photographic Optics, Orthochromatic Photography, Carbon Printing, Silver Printing, Platinum Printing, Photography as an Aid to Education, Photography by Artificial Light, Aerial Photography, Submarine Photography, Instantaneous Photography.

The Congress of Photographers will be held in Chicago some time during the month of August, 1893.

The Committee in charge of the arrangements for the various meetings of the Photographic Congress must, of necessity, be composed of persons resident in or near Chicago, to enable them to attend the meetings of the Committee. But to give the Auxiliary the benefit of the advice and counsel of persons skilled in the art-science of photography throughout the United States and the other countries of the world, and to make the Photographic Congress representative of the important interests and topics to be considered, Advisory Councils of the Photographic Congress have been, and will be, appointed from time to time.

These Advisory Councils will be composed of persons skilled in this department of Art-Science throughout the world.

It is desired that photographic societies and conventions, wherever held, shall send to this committee the names of such persons as they consider best fitted to represent them, either by the presentation of papers for the Congress, or by taking part in its discussions.

The Committee also wishes to receive suggestions as to methods of work, topics for discussion, and suitable persons to treat special subjects.

The Advisory and Honorary Members of the Congress are particularly requested to interest themselves in this direction, and to make such suggestions as they may deem proper. Photographic periodicals and individuals to whom this address is sent, are also invited to make such suggestions and recommendations at the earliest possible moment, to the end that they may be utilized by the Committee in forming the final plans in pursuance of which such Photographic Congresses will be held.

JAMES B. BRADWELL, Chairman.
GAYTON A. DOUGLASS, Vice-Chairman.
C. GENTILE,
MAX PLATZ,
M. J. STEFFENS,
ALEX. HESLER,
W. J. ROOT,
BERNARD EICHELMANN,
Committee.

NOTE.—Inquiries and communications, in relation to the proposed Photographic Congress, should be addressed to

JAMES B. BRADWELL,
Chairman of the Committee of the World's Congress
Auxiliary on a Congress of Photographers,
April 19th, 1892. Chicago, Ill., U. S. A.

ADVISORY COUNCIL.

The members of the Advisory Councils of this department, thus far appointed, are:

Arkansas—R. W. Dawson, Little Rock.

California—S. W. Burnham, San Jose.

Colorado—W. H. Jackson, Denver.

Connecticut—Charles Stuart, Hartford.

District of Columbia—Professor T. W. Smillie, Smithsonian Institute, Washington.

Georgia—C. W. Motes, Atlanta.

Indiana—W. H. Potter, Indianapolis.

Iowa—A. E. Monfort, Burlington.

Kentucky—H. Veasey, Louisville.

Louisiana—T. Lilienthal, New Orleans.

Maryland—R. Walzl, Baltimore.

Massachusetts—Frank Rowell, Wilfred A. French, H. G. Peabody, Boston.

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Minnesota—T. M. Swem, St. Paul.

Mississippi—A. L. Blanks, Vicksburg.

Missouri—F. W. Guerin, M. A. Seed, G. Cramer, St. Louis.

New Hampshire—W. G. C. Kimball, Concord.

New York—A. Bogardus, Henry J. Newton, Dr. Charles Ehrmann, P. C. Duchochois, W. I. Lincoln Adams, Dr. Arthur Elliott, New York; George Eastman, Rochester; Anton Wild, Buffalo; Edward Bausch, E. Gundlach, Rochester; Catharine Weed Barnes, Albany.

Ohio—James F. Ryder, Cleveland; M. Wolfe, Dayton; James Landy, Cincinnati.

Pennsylvania—John Carbutt, F. Gutekunst, C. R. Pancoast, F. E Ives, Philadelphia.

Rhode Island—P. H. Rose, Providence.

Wisconsin—W. H. Sherman, S. L. Stein, Milwaukee; E. R. Curtiss, Madison.

New Mexico—T. Crispell, Las Vegas.

Utah—C. R. Savage, Salt Lake.

Canada—J. F. Bryce, Toronto; A. Henderson, Montreal.

FOREIGN.

England—Mr. Andrew Pringle, Cromwell House, Bexley Heath, Kent; Mr. W. Jerome Harrison, Board School, Ichmield St., Birmingham; Mr. H. P. Robinson, Winwood, Tunbridge Wells; Captain W. deW. Abney, Chapman Jones, J. Traill Taylor, T. C. Hepworth, London; Mr. Cimbrano, W. Willis, Camera Club, London; Frank Sutcliff, Yorkshire; Henry Sturmie, Bradford; W. T. Wilkinson, Leicester; Professor Raphael Meldola, London; A. R. Dresser, W.

Van Der Weyde, W. E. Debenham, W. Bedford, Camera Club, London.

India—Schapoor Ndhedaar, Bombay; Col. J. Waterhouse, Calcutta.

Australia—W. Barnett, Sydney, N. S. W.

France—Leon Vidal, 10 Cité Rougemont, Paris; E. A. Audra, 3 Rue Logelback, Paris; J. Davanne, 82 Rue des Petits Champs, Paris; Gaston Tissandier, Societé Photographique Francais, Paris; Prof. M. Lippmann, M. Nadar, M. Marey, M. Henry Bros, Dr. Janssen, Paris.

Belgium—Jas. Mans, 59 Rue du Mousin, Brussels; Aug. Lemaire, Boulevard du Hainaut, 94 Brussels; Chas. Puttemans, Brussels; S. Maes, Antwerp; A. De Blochouse, Antwerp; Prof. Devylder, Ghent; Prof. Donney, Ghent.

Germany—M. Karl Schweir, Weimar; Mr. Fredr. Mueller, 9 Amalien Str. Muenchen; Prof. Bruno Meyor, 71 Thuraistrasse, Berlin, N. W.; Dr. Adolf Miethe, Muehlenhausen, 1 Potsdam; Herr Braun, Dornach; Dr. Hermann Vogel, Berlin; Dr. F. Stoltze, Berlin; Dr. Liesegang, Duesseldorf.

Switzerland—Boissonas, Geneva; Dr. G. Gunze, Zuerich; Dr. Barbieri, Prof. Polytechnical Institute, Zuerich; F. Pricam, Geneva.

Austria—Lt. Col. and Imp. Councillor, Ottomar Volkmer, 1 Singorstrasse, Vienna I; Imp. Councillor Dr. Ludwig Schramk, Karmehtorstrasse 7 Vienna II; Prof. Dr. Jos. M. Eder, Schottenfeldorstrasse, 77 Vienna VII; Carl Srna, Vienna; Prof. Jacob Husnik, Prag.

Russia—S. Levitsky. Pantelejemonskaja, 2 St. Petersburg; Constantin, Krzyjanowski, Turhon nor Kalinosoka, Bergamosco, St. Petersburg.

Finland—K. E. Stolberg, Helsingfors.

Holland—H. v. d. Mash Spakler, 4 Westernigplantsoen, Amsterdam; P. Freissinet, Amsterdam.

Denmark—M. Steenbro Bredgade, 20 Copenhagen; Prof. L. Denensen, Nyborg.

Sweden—Albin Roosval, Wallhallawagen, 27 Stockholm; Prof. Dr. N. C. Dunir, Upsala.

Japan—Mr. W. K. Burton, 9 Kago Yashiki, Hongo, Tokio; H. Mizno, Tokio; Sacaicho Itchome, Yokohama.

China—Bostwick, Tienstien.

Italy—Ruffo Antonio duca d'Artalia, Rome; Prof. Cav. Giorgio Roster, Florence.

South America—E. Spencer, Santiago, Chili; M. Chute, Buenos Ayres, Argentine Republic.

Hawaiian Islands—Charles Weatherwax, Honolulu.

OUR ILLUSTRATIONS.

Our Frontispiece.—As an appropriate subject for our July number we present to our readers a mechanical reproduction of a photographic study, made from the cast of Jean Antoine Houdon's life mask, which probably gives a better idea of the appearance of the illustrious original than any of the numerous paintings. This portrait was one of the features of the "Chronological Portraiture" of Washington, shown at the June meeting of the Photographic Society of Philadelphia, and was fully noted last month on page 284 of the AMERICAN JOURNAL OF PHOTOGRAPHY.

Our extra picture illustrates the second paper upon "Early Daguerrotype Days." This reproduction of the first photographic portrait made in the world direct from the original is a subject which will interest every photographer, professional and amateur. The picture is too well authenticated to admit of even the shadow of a doubt, and is a priceless relic to the photographic guild at large.

The Frozen North.—With pleasure we inform our readers that the AMERICAN JOURNAL OF PHOTOGRAPHY has a special representative on the "Peary relief" expedition to the Arctic Seas, which sailed on Monday, June 27th. Our representative is provided with a Kodak and an ample supply of Eastman's transparent films, enough to last throughout the journey to the frozen north. No attempt will be made to develop the exposures (except a few for trial) until the return of the party, or in case an opportunity presents itself the exposed rolls, carefully packed, will be sent on in advance, specimens of which will be placed before our readers at the earliest opportunity.

To remove a photograph, states the *American Bookbinder*, from an old or dirty mount, the surplus of the mount should be cut away; it should be put into a plate of cold water and be allowed to float off. A little warm water will assist in its coming away more easily, but should it not do so, the photograph has probably been mounted with a solution of india-rubber, and in that case, by holding it near the fire, the rubber will soften, and the print may easily be peeled off. Very hot water is likely to set up a reaction if the prints were not well washed by the photographer when first sent out. In mounting photographs, white boards should, as a rule, be avoided, because the color of the boards is more pure than the lights of the photograph, and deadens the effect. A toned or tinted board is more desirable.

The Metric System — What It Is.—The decimal or metric system of weights and measures, now extensively used in France and on the continent of Europe, is founded upon the metre as the unit of measure, which, as we stated the other day, is the ten millionth part of the quarter of the meridian, or of the distance from the equator to the pole. The standard, being an astronomical one, is capable of being established with exact accuracy, and is as fixed as the size of the earth. It is also very nearly, though not quite, represented by the length of the pendulum which will measure seconds of time at Paris, the difference being about one-hundredth of a metre. The length of the metre, measured by our present standard, is about thirty-nine and one-half inches.

The divisions of linear measure are formed from the metre by dividing and multiplying it by ten and multiples of ten. The names are formed by prefixing the Greek and Latin numerals for ten, a hundred, a thousand, etc., to the name of the unit. Latin terms indicate the fraction of the metre, Greek ones the multiples of that measure. Thus we have the decimetre, centimetre, and millimetre, representing respectively the tenth, hundredth and thousandth of a metre, and the decametre, hectometre, kilometre and myriametre, representing measures of ten, a hundred, a thousand, and ten thousand metres.

These measures squared, give the series of surface measures, which are the metre square, the decametre, hectometre, decimetre, centimetre square, etc. The denominations in this series, from smallest to greatest, are of course each one hundred times greater than the other.

The measures of capacity are based on the litre as the unit. The litre is a cubic decimetre, and is, if represented in ordinary terms, of the capacity of about a pint and three gills. The other denominations range by tens, hundreds, and thousands, and are designated by Greek and Latin numeral prefixes, precisely as in the case of linear measures. Thus, we have the decalitre, hectolitre, kilolitre, and the decilitre, centilitre and millilitre.

The unit of weight is the gram, which is the weight in vacuo of a cubic centimetre of distilled water at its greatest density. The denominations are by tens and hundreds, and are similarly designated with those of linear and cubic measure. The kilogram, or weight of a thousand grams, is very nearly equivalent in ordinary weights to two and one-fifth pounds avoirdupois.

These are the most essential peculiarities of the metric system. It is of course designed to be applied to weights and measures of every

kind, and for every purpose, and is subject to other modifications when required; but all these are made in strict harmony with the fundamental principles of the system. Thus, the unit of measure of land is formed from the decametre square, and is called the are. From this are formed the hectare or centimetre square — one hundred ares, and nearly equal to two and one-half English acres — and the centare or metre square, or one hundredth of the are. For great weights we have the metric quintal of one hundred kilograms, and ship's cargoes the metric ton of one thousand kilograms.

Besides the uniformity and fixedness of this system, its great beauty lies in the ease with which the different denominations and standards may be changed into each other simply by decimal multiplication and division, as in decimal numbers or Federal money. Its adoption would at one stroke wipe out from our arithmetics their complicated tables of denominate numbers, and the perplexing and unsatisfactory problems in those branches which are the dread of school-boys and school-girls. It would enable butchers, apothecaries and jewelers to understand each other's weights, and purchasers to know how much they are getting for their money.

The Fad of Autographic Plaques.—The girls have a new fad now. It is called the "autographic plaque." Like all fads it has swept the homes of the young women like wildfire, and has occasioned no end of sharp comments by members of the sterner sex, who have been mulcted of dimes. The "autographic plaque" is an ingenious device of a china-firing concern, and its purpose is financial gain for this establishment. Pieces of card-board, 10 x 10 inches in size, are distributed where they are likely to meet with a favorable reception. These pieces of card contain a circle in the centre,—a reserved space large enough for a reproduced photograph. From the circumference of this circle extend lines to a larger circle, like spokes in a wheel from the hub to the tire. The spaces between these lines are for autographs. There are fifty spaces, and it has been declared the proper thing for a girl to get the autographs of fifty of her male friends written within them. An unwritten law in this fad decrees that each autograph writer must produce a dime with his signature. When all the spaces are full and each name paid for, the girl has five dollars, and this five dollars, if sent to a certain place with the card and a photograph of the owner, will secure a china plaque with the picture and autographs reproduced and fired. It is a great scheme for the girls who have little or nothing to do, and signatures are greatly in demand.

Photographic Hints and Formulæ.

ALUMINIUM BLITZ-PULVER.

Photographie Francaise gives following formulas for the substitution of aluminium for magnesium in flash-light compounds. All are stated to give excellent results provided the aluminium powder is properly pulverized.

Aluminium powder	24 gr.
Chlorate of potassium	60 gr.
Sugar	6 gr.

or

Aluminium powder	30 gr.
Chlorate of potassium	75 gr.
Sulphide of antimony	12 gr.
Saltpetre	15 gr.

For flash lamps:

Aluminium powder	100 gr.
Nitrate of ammonia	5 gr.
Lycopodium	25 gr.

Colored flash lamp mixtures may be obtained as follows:—

Yellow light:

Aluminium	100 gr.
Lycopodium	20 gr.
Nitrate of ammonia	5 gr.
Oxalate of soda	12 gr.

Red light:

Aluminium	100 gr.
Oxalate of strontium	12 gr.
Lycopodium	25 gr.
Nitrate of ammonia	5 gr.

Green light:

Aluminium	100 gr.
Nitrate of ammonia	5 gr.
Lycopodium	20 gr.
Oxalate of barium	10 gr.
Chlorate of barium	2 gr.

Photographic Scissors and Paste.

Lantern Experiments.—Tanks can very easily be made. Take two pieces of glass narrow enough to slide into the lantern front, and about six inches long. For an open front lantern half plates suit admira bly. Place between them a piece of rubber gas tubing, roughly following the outline for three sides, and clip all together with three stout rubber bands, one at each end and one along the bottom. A tank so made is practically watertight, and can be easily cleaned after use and put together again in a minute or two.

The experiments are almost endless. A very pretty one, though scarcely chemical, is to fill the tank with water and focus on the screen; then introduce a few drops of the various aniline or resorcin colors, red, green, mauve, etc. They descend in wavy, branching spirals, and, of course, appear on the screen to ascend, usually suggesting sky rockets. By mingling several colors a very pretty effect is obtained.

Mixtures of a great number of substances, themselves soluble, produce insoluble precipitates, *e. g.*, ferrocyanide of potash and ferrous sulphate, when combined, give rise to Prussian blue. Silver nitrate and potassium bichromate form the deep red silver chromate. For screen work the solutions can hardly be too dilute, as otherwise the precipitates are too opaque. Again, put some water acidulated with sulphuric acid into the tank, and drop in a few fragments of zinc. Multitudes of bubbles of hydrogen are given off, chasing each other across the screen. With a sufficiently strong battery, water can be decomposed into oxygen and hydrogen.

One of the most telling experiments is to make a solution of litmus, with which the tank is filled; projected, it appears a deep blue color. Introduce a little vinegar or other weak acid; it immediately turns red, the effect strongly reminding one of a volcano. A few drops of ammonia or any alkali will replace the blue tinge.

There is nothing new in all this, but perhaps it may be new to one or two of your younger readers. I was myself surprised to find how easily water-tight tanks could be made in the way indicated. They are also well suited for projection of the aquatic larvæ of many insects, water fleas, and similar creatures, and being rather narrow, they can be easily kept in tolerable focus, and squirm about the disk of light in manner most comical.—*Amateur Photographer.*

How Celluloid Films are Made.—Celluloid is comparatively a new product in the arts, and dates back only to about the year 1869. It is a hard, durable substance, almost entirely unaffected by acids and alkalies, unchangeable under ordinary atmospheric conditions, and is very tough. It is rendered plastic by heat, and can be moulded into any desired form. Alcohol and acetic acid act upon it, partially dissolving it. It is soluble in acetate of amyl, forming a useful quick-drying varnish. It is manufactured in a variety of forms. Imitations of tortoise shell, amber, and malachite are produced which defy detection very often. The sheet imitation of ivory is used in photography as a basis for positives. The variety, however, which concerns us mostly now is the transparent kind, which is manufactured in sheets 1-100th of an inch in thickness, and which has a surface like glass. It is as clear, and, like glass, is not affected by moisture, which, of course, is a very great desideratum for our purpose.

The manufacture of celluloid sheets is somewhat as follows: A pile of pure white paper is acted upon by nitric and sulphuric acids, converting it into nitrocellulose. It is washed to free it from the acids, and then treated with wood spirit and camphor, producing a jelly-like block, which is then subjected to great pressure, which is sustained for several weeks. The block, from which most of the spirit is evaporated, is put into a machine something like a planing machine, and is cut into shavings of the thickness of the film required; each shaving or sheet of film, which measures 50 by 20 inches, is hung up to dry for a period of about three months, in order to thoroughly season it and prevent any after-change. Each sheet is then taken and rolled under great pressure between heated metal plates, to obliterate the marks of the cutting knife. If one takes a piece of celluloid and moistens it with alcohol, one can see very distinctly the lines caused by the knife. The metal plates are either polished or grained, according to the surface required, the polished giving the smooth film and the grained the matt surface. Both kinds are used. Some makers of negative films coat the matt film, leaving the matt surface at the back. It is no doubt very good for retouching, but the negatives take longer to print, and also the matt surface is very liable to become scratched. The gelatine emulsion is spread over the sheets by means of special appliances, which produces a film of gelatino-bromide of silver of great uniformity. The emulsion is the same as that used in the preparation of dry plates and the film, when dry, is precisely the same as a glass plate, with the exception that the support is celluloid instead of glass. The great advantage of celluloid films is, of course, the lightness and portability;

a dozen half-plate films weigh about four ounces, while the same number of glass plates will average three pounds, while in thickness one gross of films will occupy four inches and one gross of glass plates about fourteen inches. Another great advantage is that there is no fear of breakage. Halation, too, so common with glass plates, is almost entirely obviated by the use of films.

As many of our leading amateur photographers are also gentlemen farmers, the following hints, culled from our rural exchanges, may prove of interest :

Now is the time to plant soft crabs.

Pepper should be planted in hot weather.

You should always use a soft sponge in washing sheep.

Mosquitoes should be muzzled from February 28 until December 1.

Raisins are best planted in sandy soil. This prevents them from becoming dry.

Never shake your pumpkin trees. Take a ladder and pick them to prevent bruising.

Sweet potatoes, to be well kept during the winter, should be stored in a fire-proof safe.

The best way to smoke hams is to fasten your hogs in the pen and put a match to the building.

A good way to rid potato vines of the Colorado beetle is to catch the bug between the thumb and forefinger and crush it between the teeth.

World's Fair Note.—Helena, Montana, will send to the Exposition a meteor discovered near that city. It is composed of nickel and magnetic iron, and is in two pieces of ninety and seventy pounds respectively. It is reported that when found these pieces were in a hole in the ground large enough to contain a house, from which fact it is inferred that the meteor exploded when it struck the earth.

Arson.—Harry L. Hall, Shenandoah, Va., a photographer, was committed without bail May 23d on a charge of arson.

Frederick Richter, a young photographer, is also in jail as one of the conspirators. Hall left town after instructing Richter to apply a match to a two-inch piece of candle placed on some turpentine-soaked rubbish in his gallery.

Richter told the police, and Hall was arrested in Frackville. The property was insured for $300.

THE PHOTOGRAPHIC SOCIETY OF PHILADELPHIA.

A STATED meeting of the society was held on Wednesday evening, June 8th, 1892, Mr. Joseph H. Burroughs, president, in the chair.

The Board of Directors reported that at the conversational meeting, May 25th, the prize lantern slides sent to the American Interchange by the English journal, *Photography*, were shown.

Mr. Harrison D. Stratton was elected an active member at the board meeting, June 2d.

The family of the late Mr. William L. Springer have presented to the society a collection of lantern slides made by Mr. Springer.

A communication from Mr. F. C. Beach, editor of the *American Amateur Photographer*, was read, in regard to a petition for the extension of the photographic privilege at the World's Fair in Chicago in 1893.

On motion of Mr. Taylor, the president was authorized to sign the petition representing the two hundred active and life members of the society.

Mr. G. B. Wood exhibited a small camera which a friend of his had brought from Paris. It was of the size and shape of an opera or field glass, and carried 12 plates, size 2⅜x1¾. The lens was of a universal focus, and was contained in one side of the camera. The other side was used as a finder, the exposure being made by an exposing shutter on the lens.

Mr. G. B. Wood also exhibited a very ingenious dark lantern for use when traveling. It contained a reservoir for stearine, so arranged that when the lamp was lighted the heat melted the stearine, which then ran down to the wick. The lantern was small and compact, and could be readily packed for traveling.

Mr. Jennings exhibited a series of lantern and stereoscopic slides of lightning flashes. The stereoscopic pictures, he claimed, were the first ever made of the heaven's electrical discharges, and the stereoscopic effect was decided interesting. In one case the sensitive plate had caught the mystical thunderbolt, from which radiated, in various directions, numerous tongues of flame. The theory of the exhibitor was that thunderbolts were formed by a collison of flashes and a consequent scattering of the discharge into a number of points or balls of flame, which travelled onward into space on their own account.

In another view the stereoscope revealed the fact that a discharge apparently zig-zag in its direction, was usually spiral in its course.

Mr. Brown submitted two negatives for inspection, one of which, a flash-light picture, was disfigured by a wavy ribbon of light across the centre. The other was dotted with small circular spots of white glass. The latter, he believed to be due to the use of a rose nozzle in washing, —a wearing away by the continued action of water, but the former he was utterly at a loss to account for.

Mr. Wood stated that he noticed the other day, on examining certain negatives taken seven or eight years ago, that the film was leaving the plate,—coming off in great flakes. The plates were not frilled when developed, and he thought perhaps the alum bath rendered the film brittle, and gave it a tendency to leave the plate.

Mr. G. M. Taylor said he knew of an instance where the film had left the celluloid altogether,—had peeled off in one piece.

Mr. Young exhibited negatives made by the new Zeiss Anastigmat lens, manufactured by the Bausch & Lomb Co. The lens was 4x5, but Mr. Young tried it on a 6½x8½ plate, with full opening, and it covered the plate well to the margin. The definition, depth of focus and rapidity were remarkable.

Mr. Pancoast showed a panoramic photograph of the city of Waterbury, Conn., which he had taken by means of an adjustable tripod top of his own manufacture. Four 8x10 plates were used, and the pivotal top he had carefully subdivided into four positions, embracing in all 101 degrees. He had a supplementary arrangement with five positions, which would take in 124 degrees. The picture exhibited showed great uniformity, and the continuity was admirable.

At the conclusion of the meeting a series of slides, presented to the society by the family of the late Mr. Springs, formerly a member of the society, were shown upon the screen, together with others contributed by members present for the evening's entertainment.

Adjourned. ROBERT S. REDFIELD, *Secretary.*

World's Fair Note.—Philadelphia's contribution to the Pennsylvania exhibit at the Fair will include a number of articles of great historic interest. Among them are the desk and chairs used in the Continental Congress, and the celebrated portraits of the signers of the Declaration of Independence.

LUMINOUS PAINTS IN ALL COLORS.

A GERMAN contemporary gives the following series of receipts for these paints, which may prove useful. The luminous paints can also be used as wax colors for painting on glass and similar objects, by adding, instead of the varnish, ten per cent. more of Japanese wax and one-fourth the quantity of the latter of olive oil. The wax colors prepared in this way may also be used for painting upon porcelain, and are then carefully burned without access of air. Paintings of this kind can also be treated with water glass. For orange luminous paint, 46 parts varnish are mixed with 17.5 parts prepared barium sulphate, 1 part prepared Indian yellow, 1.5 parts prepared madder lake, and 38 parts luminous calcium sulphide. For yellow luminous paint, 48 parts varnish are mixed with 10 parts barium sulphate, 8 parts barium chromate, and 34 parts luminous calcium sulphide. For green luminous paint, 48 parts varnish are mixed with 10 parts prepared barium sulphate, 8 parts barium chromium oxide green, and 34 parts luminous calcium sulphide. A blue luminous paint is prepared from 42 parts varnish, 10.2 parts prepared barium sulphate, 6.4 parts ultramarine blue, 5.4 parts cobalt blue, and 46 parts luminous calcium sulphide. A violet luminous paint is made from 42 parts varnish, 10.2 parts prepared barium sulphate, 2.8 parts ultramarine violet, 9 parts cobaltous arsenate, and 36 parts luminous calcium sulphide. For gray luminous paint, 45 parts of the varnish are mixed with 6 parts prepared barium sulphate, 6 parts prepared calcium carbonate, 0.5 parts ultramarine blue, 6.5 parts gray zinc sulphide. A yellowish brown luminous paint is obtained from 48 parts varnish, 10 parts precipitated barium sulphate, 8 parts auri-pigment, and 34 parts luminous calcium sulphide.

Luminous colors for artists are prepared by using pure East India poppy oil in the same quantity instead of the varnish, and taking particular pains to grind the materials as fine as possible. For luminous oil color paints, equal quantities of pure linseed oil are used in place of the varnish. The linseed oil must be cold-pressed and thickened by heat.—*Building World.*

In the Twilight Hour.

WE learn rapidly when our teachers are those we love.

IT is often better to have a great deal of harm happen to one than a little, since a great deal will arouse us to remove what a little will only accustom us to endure.

EVERY day sends to their graves a number of obscure men, who have only remained in obscurity because their timidity has prevented them from making a first effort, and who, if they could have been induced to begin, would in all probability have gone great lengths in the career of fame.

RECKLESS youth makes rueful age.

A MAN should never be ashamed to own he has been in the wrong, which is but saying that he is wiser to-day than he was yesterday.

ASSOCIATE with men of good judgment, for judgment is found in conversation, and we make another man's judgment ours by frequenting his company.

FRIENDSHIP often ends in love, but love in friendship never.

THE supreme happiness of life is the conviction that we are loved.

TO most men experience is like the stern light of a ship, which illuminates only the track it has passed.

HE is unworthy to live who lives only for himself.

A LONG life hath long miseries.

IF rich be not elated; if poor be not dejected.

EVERYBODY knows worse of himself than he knows of other men.

IF you would be known and not know, vegetate in a village; if you would know, though you be not known, live in a city.

IT is with narrow-souled people as with narrow-necked bottles,—the less they have in them, the more noise they make in pouring it out.

HE that fears you present will hate you absent.

THAT best portion of a good man's life, his little nameless, unremembered acts of kindness and love.

WOMEN have more of what is termed good sense than men. They cannot reason wrong, for they do not reason at all. They have fewer pretensions, are less implicated in theories, and judge of objects more from their immediate and involuntary impression on the mind, and therefore more truly and naturally.

THE generous heart should scorn a pleasure which gives others pain.

WHEN a woman fancies herself slighted by the man she loves, the first person who proposes must be a clumsy wooer indeed if he does not carry her away.